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A SAMPLING FORK FOR ESTIMATING POPULATIONS OF SMALL ARTHROPODS

By Charles F. Henderson, Entomology Research Branch[1/]

When studies of the biology, ecology, and control of the brown wheat mite (Petrobia latens (Müll.)) were planned, it was first necessary to develop a method of estimating mite populations on various small grains. The first method tried was to dislodge the mites by brushing the host plant back and forth with the hand, and to count those that fell on a white card held beneath the foliage. These mites readily fall to the ground when the plant upon which they are feeding is disturbed. However, this procedure was too slow where large numbers of small-unit samples had to be taken quickly under comparable conditions of temperature, light, and time of day. Population estimates in plots sampled early in the day were not comparable with those taken later. Furthermore, a method was desired in which the samples could be taken to the laboratory and the mites counted under more favorable conditions. The apparatus and technique developed for these studies are described herein.

Description of Fork

In the fall or winter when the plants are small, the most satisfactory population estimates may be made by counting the mites on the foliage of 1-foot sections of planted row, with a head binocular (fig. 1). In the spring and summer after the plants had begun their upright growth, the mites were caused to drop from foliage to adhesive-covered glass slides held in a galvanized-iron sampling fork (fig. 2), similar to one described by Lawson (1). This fork consists of four tines attached to a tubular steel handle that extends from the base at an angle of about 15 degrees. Around the edge of each tine is a retaining rim. The points of the tines are beveled on the bottom to prevent them from digging into the ground when the fork is pushed along the soil surface. The slides are of single-strength window glass, and just large enough to slip into the rectangular chamber of the tine.

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For convenience in handling, four slides are placed in an aluminum clip which has the ends turned back over the slides so that the glass surfaces will not touch when several clips are stacked (fig. 3). Two upturned stops on the back margin of the clip prevent the slides from falling out. While held in the clip, the upper surfaces of the four slides are coated by brushing with a hot mixture of mineral oil and vaseline. The proportion of the two ingredients depends upon field temperatures. The mixture should be fluid enough to spread uniformly in a thin film over the slide without showing brush marks, but firm enough not to flow under high temperatures. Brush marks greatly hinder the counting, as only those mites directly above white areas showing through the glass slides are counted, and the uneven refraction of light through irregular adhesive surfaces obscures the outline of these areas. Three parts of mineral oil to one of vaseline is satisfactory; the proportion of vaseline is increased with higher temperatures and decreased with lower ones. The mixture may be applied cold, but it is more difficult to avoid leaving brush marks when applying a thin film.

After the slides have been coated, they are stacked in one side of a metal slide box (fig. 4). This box has two compartments--one for carrying the clean, coated slides to the field and the other for holding the slides after the mites have been collected. Three of these slide boxes are placed in a metal case for carrying to the field (fig. 5). A large number of the slides may be coated and held indefinitely in these carrying cases for future sampling.

In the field to be sampled a slide box is removed from the carrying case and taken to the sampling site. A clip of slides is taken from the box and rested on the flat surface of the fork. The slides are then removed individually from the clip and inserted in the tines of the fork with the adhesive surface on top, being held in position by the retaining rim (fig. 6). The sampling fork is then ready for use.

Using the Fork

The fork containing the coated slides is inserted through the base of the plant at ground level (fig. 7), and the foliage is disturbed by brushing with the hand so that the mites will drop to the ground; those that fall on the slides are held by the adhesive. The fork is then withdrawn and the slides are replaced in the clip. The bottom or outside top margin of the clip is labeled with a lead pencil as to sampling site, date, host, or other desired data. The clip of slides is then returned to the holding box, and when all the collections have been made the box is placed in the carrying case and brought back to the laboratory for counting. The samples may be held in good condition for many days in the refrigerator.

Counting the Mites

For counting the specimens a thin transparent celluloid card is inserted between the glass slides and the metal clip. This counting card (fig. 8) has four white areas 1/4 or 1/8 inch wide and 4 1/4 inches long, so arranged that they will coincide with the approximate centers of the four slides when the card is shoved tightly against the retaining stops. The white areas may be made with plastic paint or plastic tape. Counting is done with reflected light from an ordinary microscope lamp.

When a card containing 1/4-inch strips is used, each slide represents a sample area of 1.06 square inches, and each fork 4.25 square inches (approximately 1 inch of planted row). When a 1/8-inch strip is used, one-half these areas are represented. No statistical differences were observed between counts made with the two areas. Other types of counting patterns may be used, such as four 1/4- by 1-inch areas placed one above the other in the center or run diagonally across the card. The differences between such patterns did not exceed 4 percent.

If the number of mites present over the counting area is not sufficient for an adequate count, the entire slide may be examined under lower power. Furthermore, where low populations occur or slide-carrying space is limited, as on an extended survey, a composite sample may be taken on a single set of four slides, and so labeled.

After the counts have been completed, the slides are placed in a cylindrical wire screen basket and submerged in a solvent (fig. 9) where they are agitated a few times and then allowed to soak to dissolve the mineral oil and vaseline. The clean slides may then be wiped with a rag or placed in hot water and spread out on a rack to dry. If cleaner slides are desired, they may be agitated in hot, soapy water after being removed from the solvent, and then rinsed in hot water. The metal clips are cleaned by wiping with a rag moistened with solvent, or soaking in the solvent and then wiping.

Other Uses of the Sampling Fork

The sampling fork was found to be very satisfactory for estimating populations of the spotted alfalfa aphid and various species of thrips and other insects found in alfalfa fields. However, the optimum proportion of mineral oil and vaseline varies with the insects being collected. For example, a 5 to 1 mixture retained practically all the aphids, whereas a few were able to escape when 3 parts of mineral oil to 1 part of vaseline was used. When several species are present, the proportion should be the one that will catch those insects most likely to escape. By this procedure the fork should be practicable for sampling any small athropod attacking small grains that has a tendency to fall when the plant is disturbed.

The color of the counting area on the celluloid card should vary with the color of the insect. For example, for the spotted alfalfa aphid, which is pale greenish yellow, a dark background should be used. For the brown wheat mite and other dark species a white background is the most satisfactory.

Literature Cited

(1) Lawson, F. R., D. E. Fox, and W. C. Cook
1941. Three new devices for measuring insect populations. U.S. Bur. Ent. and Plant Quar. E-183, 6 pp.

Figure 1.--Counting brown wheat mites on small wheat plants in 1-foot sections of planted row with head binocular.

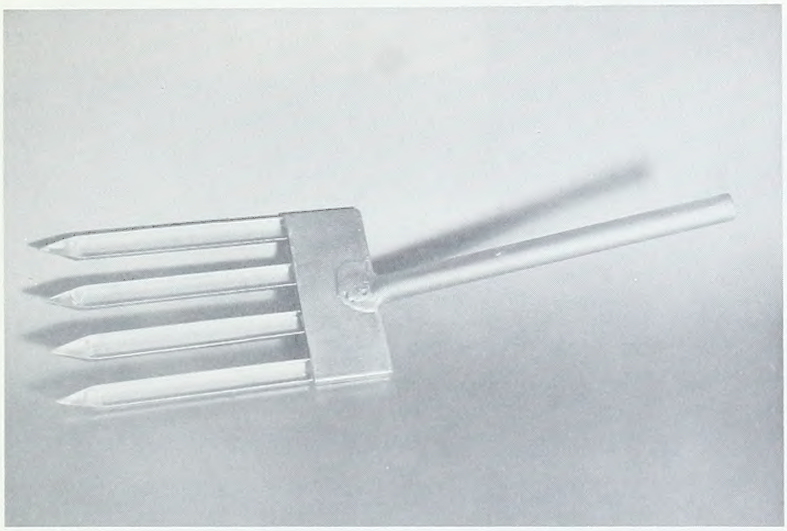

Figure 2.--Sampling fork for collecting brown wheat mites from foliage of small grains for counting.

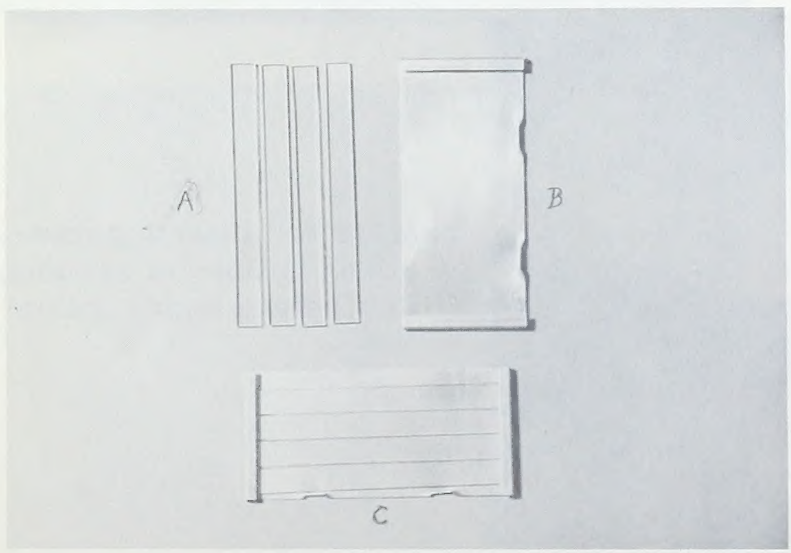

Figure 3.--A, glass slides; B, aluminum clip; C, glass slides in clip ready for application of adhesive.

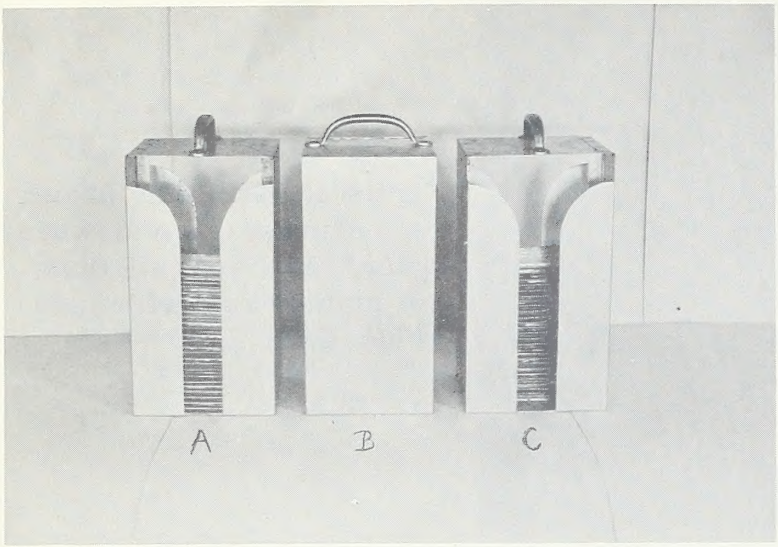

Figure 4.--Slide box for carrying clips of coated slides to sampling site; A, front view showing empty slides stacked in front compartment; B, side view; C, front view showing slides in rear compartment after collections have been taken.

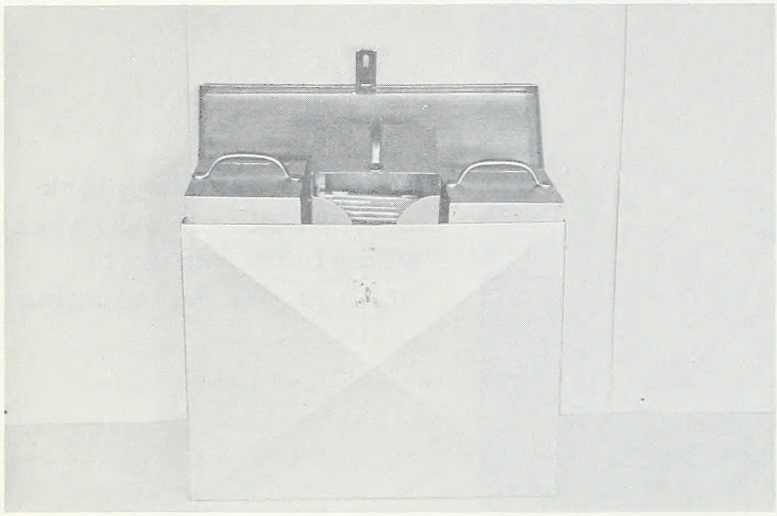

Figure 5.--Carrying case for holding three slide boxes.

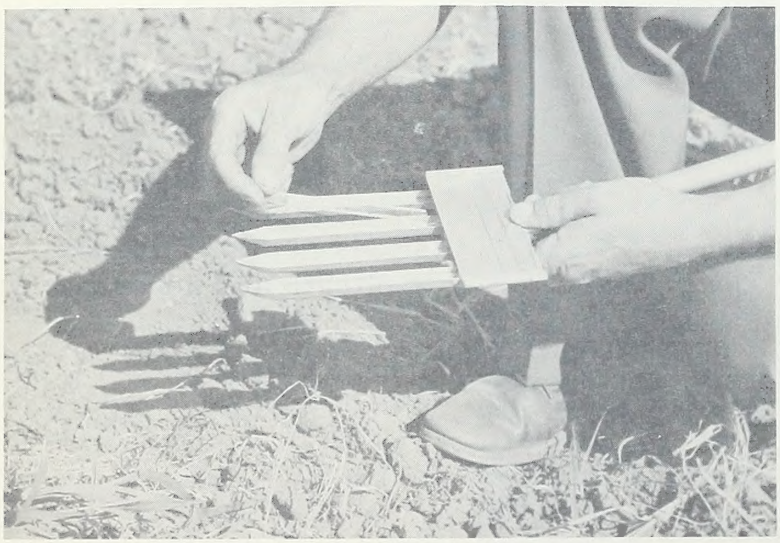

Figure 6.--Inserting coated slides in tines of sampling fork before taking collection.

Figure 7.--Sampling clump of grass for populations of brown wheat mite.

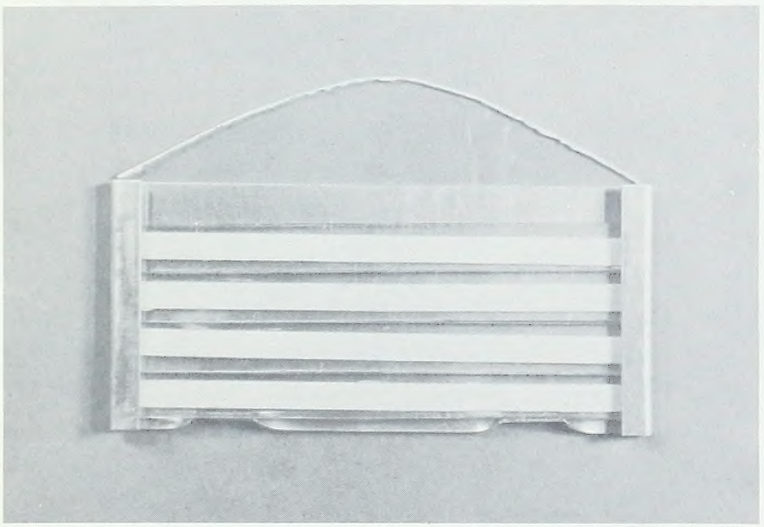

Figure 8.--Celluloid counting card inserted between glass slides and metal clip. White counting areas are 1/4 inch wide.

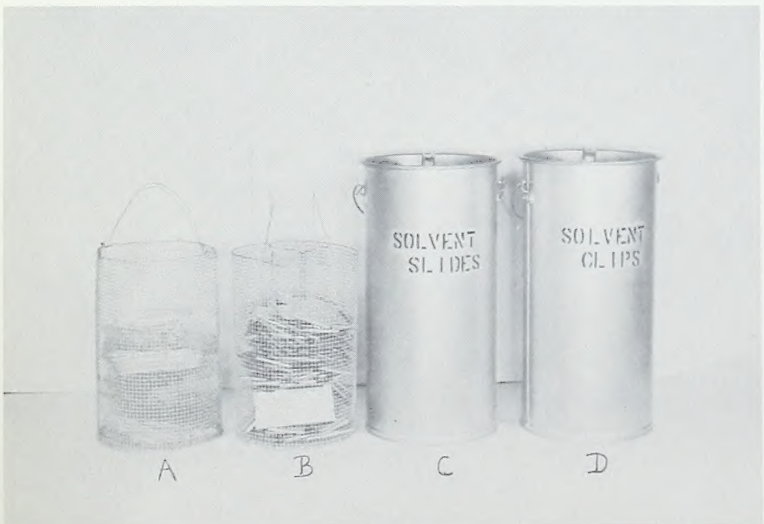

Figure 9.--Apparatus used in cleaning slides: A, Wire basket of clips ready for soaking in solvent; B, basket of clips; C, cream can containing solvent for cleaning slides; D, solvent for cleaning clips.

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